

REMARKS

Claims 1-23 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejection(s) in view of the remarks contained herein.

In the Amendment dated March 3, 2003, Applicants pointed out the fact that skilled artisans have had difficulty commercializing switched reluctance machines. Typically, the cost of a suitable rotor position sensor makes switched reluctance machines commercially non-competitive with other types of machines. Therefore, skilled artisans have been attempting to implement switched reluctance machines with sensorless rotor position sensing to reduce the cost of the switched reluctance machines and to make the switched reluctance machines more competitive.

X
Applicants admit that the use of the sensorless approach with a switched reluctance machine is old and even cited several references supporting this teaching in the Specification. Applicants also provided sufficient evidence that the art has tried to solve the problem of successfully implementing switched reluctance machines with sensorless rotor position sensing.

Not Relevant
Applicants are unaware of any successful, high production implementations of a switched reluctance machine with sensorless rotor position sensing. Invariably, either the sensorless drive circuit needs to be highly sophisticated (and too costly – rendering the switched reluctance machine uncompetitive) or the sensorless drive circuit lacks sufficient precision (and the performance is unacceptable).

The Examiner relied upon several references (Nishiyama and Kliman). Applicants are well aware of the dates of these two references. Applicants cited similar

references that support the exact same teachings and that were significantly older. Applicants pointed out the fact that in all of the attempts to make the sensorless approach work in a switched reluctance machine, none of the references attempted to segment the stator and to wind the segments individually, precisely and with a high slot fill to make the electrical characteristics of the stator windings more uniform.

Applicants have found that the improvements in the electrical characteristics allow the sensorless drive circuit to be less sophisticated and less costly. This, in turn, allows the switched reluctance machines to be produced at a cost that is much closer to the cost of competing machines.

None of the references that relate to switched reluctance machines show, teach or suggest using a segmented stator and winding the individual segments with the high slot fill. The Examiner incorrectly relies upon art relating to other types of machines to provide the incentive to segment the stator (such as the permanent magnet machines shown in Nishiyama). Applicants pointed out the fact that the use of segmented stators in other types of machines was very old – not that that Nishiyama reference was old.

Applicants also pointed out the fact that the art has been trying to solve the problem of a cost effective sensorless drive circuit approach. Despite the existence of the problem and the existence of the segmented stators in other types of machines, no one thought to provide the solution set forth by Applicants.

The Examiner admits that Kliman was not concerned with the winding of the stator. **Office Action at p.5.** The Examiner goes on to argue that one skilled in the art would look to Nishiyama to make the stator of the switched reluctance machine in Kliman easier to wind. It is unclear why one would be looking to make the stator of

Kliman easier to wind unless one has the benefit of Applicant's specification, which is improper hindsight reconstruction. With these thoughts in mind, Applicants will now address the specific rejections.

REJECTION UNDER 35 U.S.C. § 103

Applicants traverse the rejection of Claims 1-5 and 8 under 35 U.S.C. § 103 as being anticipated by Kliman et al. in view of Applicant's Admitted Prior Art (APA) and further in view of Nishiyama et al.

With respect to independent Claim 1, Kliman et al. does not show, teach or suggest an electric power steering system that includes a switched reluctance machine with a segmented stator.

Nishiyama et al. does not show, teach or suggest a switched reluctance electric machine or an electric power steering system. Nishiyama et al. relates to permanent magnet machines and not to switched reluctance machines.

Motivation
In Applicant's prior response, Applicants asserted that the proposed combination of Kliman et al. and Nishiyama et al. was not obvious. Applicants identified similar, significantly older references that support the same teachings as those found in Kliman et al. and Nishiyama et al. In particular, switched reluctance motors with non-segmented stators that are similar to those taught by Kliman et al. have been around since the mid 1800's. Permanent magnet motors with segmented stators that are similar to those shown in Nishimaya et al. are shown in Sheldon (U.S. Patent No. 2,688,103, which was issued in 1952).

While the age of the references, standing alone, is not persuasive on the issue of non-obviousness, the age of the references coupled with the failure to solve the problem in light of the presumed knowledge of the references is persuasive on the issue of obviousness. As stated in In re Neal:

Appellant points out that the references are "quite old" and considers that an indication that this combination would not have been obvious. Such a position is not impressive "absent some showing that the art tried and failed to solve some problem notwithstanding its presumed knowledge of the references." In re McGuire, 57 CCPA 706, 712, 416 F.2d 1322, 1327, 163 USPQ 417, 421 (1969).

In re Neal 179 USPQ 56, 57 (CCPA 1973).

In spec. Applicants segmented the stator of the switched reluctance machine to improve the electromagnetic characteristics of the stator segments, which makes sensorless control easier to implement. Successfully implementing sensorless control in switched reluctance machines has been a long standing problem in the art of switched reluctance machines.

But it was been done. Switched reluctance machines require rotor position information for control. There are two approaches that are commonly used. The sensed approach uses a sensor that physically senses the rotor position. The sensed approach typically renders the switched reluctance machines too costly to compete with other types of machines. The increased cost of direct rotor position sensing and the failure to successfully implement less-costly sensorless rotor position sensing have been significant factors preventing the widespread sale and/or use of switched reluctance machines. Since attempts to reduce the cost of direct rotor position sensing have failed, there has been significant interest in the sensorless approach, which has the potential to reduce parts and to be less costly.

Many references discuss the cost problems of direct sensing methods and the difficulty in implementing sensorless approaches. For example, Tang (U.S. Pat. No. 5,811,905) recognizes the increased cost of direct sensors (**Col. 1, lines 46-52**) and the difficulty in implementing "sensorless" rotor position techniques (**Col. 1, lines 52-60**). Kolomeitsev (U. S. Patent No. 5,777,416) also recognizes the increased cost of direct sensors (**Col. 1, line 66 to Col. 2, line 6**) and the unsatisfactory performance of sensorless rotor position techniques (**Col. 2, lines 7-13**). Liu et al. (U.S. Pat. Nos. 6,107,772) likewise recognizes the cost problems with direct sensors and the performance problems with sensorless sensing (**Col. 1, line 60 to Col. 2, line 6**).

Despite the known problems relating to sensorless control techniques and the presumed knowledge of the references, no one has proposed an electric power steering system that includes a switched reluctance machine with a segmented stator as set forth in claim 1.

Segmenting the stator as taught by Applicants allows the stator segments to be precisely wound. The precise winding allows the inductance and resistance characteristics to be controlled from one stator segment to another and from one machine to another. The controlled inductance and resistance characteristics, in turn, make sensorless control systems easier to implement.

In supporting the combination, the Examiner states that it "would have been obvious to modify Kliman by making the stator segment assemblies having the shape taught by Nishiyama so that the winding may be formed easily. (Col. 4, line 49) This would have also been obvious since [segmenting the stator] is extremely common in the motor art". **Final Office Action** at paragraph 4.

There are several significant problems with the Examiner's analysis. First, Kliman et al. is directed to the problem of detecting and isolating faults in a switched reluctance machine. **See Col. 1, lines 6-11.** Kliman et al. does not even address the problem of making the stator of a switched reluctance machine easier to wind. It is therefore unclear why one would look to Nishiyama et al., which relates to a different type of machine, to solve problems relating to sensorless rotor position sensing.

Second, the Examiner alleges that it would be obvious to segment the stator in Kliman et al. because segmenting the stator is common in the ^{motor} machine art. While this may be true with respect to some types of electric machines, this statement is not true with respect to switched reluctance machines. Applicants are aware of no switched reluctance machines that are segmented to allow precise winding and have high slot fill.

The Examiner's reasoning is exactly the type of speculation that formed the basis for reversal of the Examiner and the Board in In re Jones:

Conspicuously missing from this record is any evidence, other than the PTO's speculation (if it be called evidence) that one of ordinary skill in the herbicidal art would have been motivated to make the modifications of the prior art salts necessary to arrive at the claimed 2-(2'-aminoethoxy) ethanol salt... We conclude that the PTO did not establish a prima facie case of obviousness.

In re Fine also rejected this reasoning. There, the prior art reference related to a similar device – namely gas chromatographs. Id. The prior art chromatograph detected sulfur while Applicants' chromatograph detected nitrogen. Id.

Both In re Fine and In re Jones reject the proposition that the teaching, suggestion or motivation required by §103 is present simply because the references all relate to the same broad category of art or that unsupported general knowledge of one

skilled in the art can be relied upon. The Examiner is essentially asserting that it would be obvious for skilled artisans to try the features of one device in another similar device.

The CAFC expressly rejected the "obvious to try theory" in In re Fine at 1598.

The sole motivation for making the proposed combination is provided by Applicants' specification, which is impermissible hindsight reconstruction. As succinctly stated by the CAFC:

But this court has said, "To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." W. L. Gore , 721 F.2d at 1553, 220 USPQ at 312-13. It is essential that "the decisionmaker forget what he or she has been taught at trial about the claimed invention and cast the mind back to the time the invention was made . . . to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art." Id . One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

In re Fine at 1600.

Applicants traverse the rejection of Claims 9-13, 16-19, 22 and 23 under 35 U.S.C. § 103 as being anticipated by Kliman et al. in view of Applicant's Admitted Prior Art (APA) and further in view of Nishiyama et al, McCann and Ackermann.

Applicants incorporate the comments set forth above that relate to Claim 1.

Neither McCann nor Ackermann show, teach or suggest a switched reluctance electric machine with a segmented stator and with a slot fill of 70-95%.

McCann shows a switched reluctance machine with a non-segmented stator. As such, either transfer winding or needle winding would typically be used to wind the

stator teeth. These methods are generally limited to less than 65% slot fill (Specification at [0011]) and certainly cannot obtain the claimed slot fill of 70-95%.

As best understood by Applicants, Ackermann states that salient pole motors have slot fills of 40-50%. However, induction machines, according to Ackerman, have slot fills approaching 70% because bobbin and oscillating guns can be used. **Col 2, lines 16-19.** Ackerman goes on to describe a method for increasing slot fill of **salient pole machines** substantially higher than slot fills obtainable by prior art techniques (e.g. substantially higher than 40-50%). **Col. 3, lines 7-27, Col 6, lines 42-45.** Ackermann does not improve slot fill of induction machines.

Neither Ackermann nor McCann teach a segmented switched reluctance machine with 70-95% slot fill. Therefore, Applicants believe that claims 9 and 16 are in allowable form. Claims 10-15 and 16-23 depend directly or indirectly from claims 9 and 16 and are allowable for the same reasons.

Applicants traverse the rejection of Claim 6 under 35 U.S.C. § 103 as being anticipated by Kliman et al. in view of Applicant's Admitted Prior Art (APA) and further in view of Nishiyama et al, McCann, Ackermann and Trago et al.

Applicants incorporate the comments set forth above.

Neither McCann nor Ackerman show, teach or suggest a switched reluctance electric machine with a segmented stator, with a slot fill of 70-95% or with end caps as claimed.

Trago et al does not show, teach or suggest end caps that are connected to opposite axial ends of said stator segment cores of individual stator segments. Trago et

al does not show, teach or suggest first and second end cap retainer sections that extend along projections and that connect the first and second end caps.

The end caps in Trago et al. are not for stator segment cores of individual stator segments as claimed. The end caps in Trago et al. also do not include end cap retainer sections as claimed.

Therefore, Applicants believe that claim 6 is allowable over the prior art of record for these reasons.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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